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The effect of New Tubulicid® on smear layer removal

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SUMMARY

The effects of new Tubulicid [R] (a commerical cavity cleanser which contains 0,2 per cent disodium EDTA) on smear layer removal from ground and cavity dentine surfaces with and without mechanical agitation were determined. None of the surfaces displayed smear layer removal scores greater than one. Although mechanical agitation appeared to improve the smear layer removal properties of new Tubulicid [R] this was found not to be significant. The difference between smear layer removal from ground surfaces and cavity surfaces was also found not to be significant. A significant difference in smear layer removal ($p<0,02$) was however, found when flat ground dentine treated with new Tubulicid [R] and mechanical agitated surfaces were compared to cavity surfaces subjected to chemical cleansing alone.

OPSOMMING

Die vermoeë van nuwe Tubulicid[R] ('n kommersiële kaviteitsreiniger wat 0,2 persent dinatrium EDTA bevat) om smeerlae vanaf geslypte dentien en vanaf dentienvlakke van kaviteite te verwyder, met of sonder enige meganiese vrywing, is bepaal. Nie een van die oppervlakke het 'n smeerlaagverwyderingstelling van meer as een getoon nie. Alhoewel vrywing die smeerlaagverwyderingseienskappe van nuwe Tubulicid[R] verbeter het, was dit nie betekenisvol nie. Die verskil tussen smeerlaagverwydering vanaf geslypte dentien en vanaf kaviteitsdentien, was ook nie betekenisvol nie. 'n Betekenisvolle verskil in smeerlaagverwydering ($p<0,02$) is egter gevind wanneer platgeslypte dentienvlakke wat met nuwe Tubulicid[R] behandel is en gevryfde vlakke, vergelyk is met ongevryfde kaviteitsvlakke wat net aan chemiese reiniging onderwerp is.

INTRODUCTION

In recent years much attention has been given to the problems bearing on adhesion between the hard tissue surfaces of the tooth and various types of cements and restorative materials. Smear layer removal may improve adhesion, provide better adaptation of the restorative material and facilitate the removal of microorgansims from cavities. The disadvantages are that there may be adverse pulpal responses, the involvement of an extra procedure is required and smear layer removal may inadvertently interfere with the development of marginal seals. Jodaikin and Austin (1981) and Jodaikin, Austin and Vieira (1981) investigated smear layer removal with chelating agents after cavity preparation and found that only chelating agents containing relatively high concentrations of EDTA appeared to have smear layer removal properties. Recently Brannström, Nordenval and Glantz (1980) stated that since the smear layer attached to cut dentine surfaces probably contain high amounts of calcium phosphate it was of interest therefore to know whether these layers could be displaced or whether cavity surfaces could be morphologically changed by the addition of a chelating agent to a surface active cleanser. It was shown that the new Tubulicid [R]* removed most of the smear layer from ground tooth surfaces when applied in conjunction with a surface rubbing action. However, Jodaikin and Austin (1981) and Jodaiken *et al* (1981) have shown that new Tubulicid [R] does not remove smear layer from the dentinal regions of cavity preparations when applied without mechanical agitation. The difference between the studies by Brannström *et al* (1980) on the one hand and Jodaikin and Austin (1981) and Jodaikin *et al* (1981) on the other is that the former researchers examined flat surfaces with mechanical agitation of Tubulicid [R] whereas the latter examined cavities without mechanical agitation of the Tubulicid [R]. The aim of this investigation was to determine the effect of new Tubulicid [R] on smear layer removal from ground tooth surfaces and cavities prepared in monkey teeth with and without a mechanical cleansing.

*Tubulicid® (blue label) Amphoteric- 2,0, 3 g; Benzal-kon chloride 0,1 g; Disodium edtatedehydrate 0,2g; Phosphate buffer solution and pH 7,3g; aqua dest. ad 100g. Dental Therapeutics A B Nacka 1, Sweden.

METHOD AND MATERIALS

Cervical grooves were cut on the proximal and labial surfaces of 32 incisor monkey teeth to facilitate crown removal by cervical fracture. Their oral cavities were thoroughly rinsed with water to remove saline and loose debris. The teeth were then dried with compressed air. Sixteen standard cavities were cut at high speed with a tungsten carbide bur in the centre of the labial surfaces of alternate teeth and 16 incisor crowns were ground horizontally, thus exposing dentine. The

cavities and ground surfaces were rinsed with water and dried with compressed air. Surfaces to be treated with or without a mechanical technique were allocated by random selection.

On the surfaces where a mechanical action was used, the Tubulicid [R] saturated sponge pellets were applied by scrubbing of the surface for 5 seconds. The sponge pellet was then left in contact with the surface for a further 50 seconds followed by scrubbing for another 5 seconds. In the second group which received the chemical treatment alone the saturated sponge pellets were placed on the flattened tooth surfaces or into the prepared cavities for 60 seconds. At the end of each treatment the test surfaces were thoroughly rinsed.
The crowns of the treated teeth were separated from the roots by a fracture through pre-cut cervical grooves using extraction forceps. The tooth specimens were placed in 10 per cent buffered formal saline for fixation and dehydrated using the critical point method for scanning electronmicroscopy. The specimens were individually mounted on an aluminum stub with a colloidal graphite suspension, coated with gold palladium and the treated surfaces examined independently by 2 examiners. Photomicrographs of the representative surfaces of the cavity wall were taken at a magnification of 1000 X.

The smear layer removal effect as judged by surface features in the photomicrographs prepared of the 4 groups of treated surfaces were scored independently by the 2 examiners using the scoring system as described by Jodaikin and Austin (1981). This enabled 4 degrees of smear layer removal from the dentine surface to be identified (Jodaikin *et al* 1981). A randomly selected sample of 20 per cent of the photomicrographs were re-examined. The results of the reassessment was subjected to the student's paired 't' test to test for inter-intra examiner variability. No significant differences were found.

The results of the surface cleansing effect of the 2 types of treatment on the flat ground and cavity surfaces are shown in Table 1.

None of the surfaces treated by any of the cleansing methods had a smear layer removal score of greater than one, whilst 3 of the flat surfaces which received the chemical treatment alone had smear layers with score one and 5 a score of zero. Of the cavities that were scrubbed in conjection with the new Tubulicid [R] treatment 4 had score one and 4 a score of zero, and the cavities without the scrubbing action 6 had a score of zero and 2 a score of one (Table 1). It was therefore evident that a thinning of smear layer occurs more readily in the flat surfaces which have been scrubbed. The surfaces that were not scrubbed in conjunction with the new Tubulicid [R] treatment displayed the least amount of smear layer removal.

Table 1: The results of the surface cleansing effect of 2 types of treatment on the flat ground and cavity surfaces.

Surfaces	Smear layer	
	Score 1	Score 0
Flat scrubbed	7	1
Flat	3	5
Cavity scrubbed	4	4
Cavity	2	6

When comparing smear layer removal effects based on a scoring system of either zero or one within each group the results suggested that mechanical action appeared to improve smear layer removal. The results were not however significantly different. Smear layer removal from ground surfaces and cavity surfaces showed a similar pattern. A significant difference in the removal of smear layer ($p<0,02$) was however, found between the group of ground surfaces when compared with cavity surfaces without mechanical action.

The significant difference in the results obtained in this study and that of Brannström *et al* 1980 study could be attributed to one of the following factors. Firstly the sample sizes could possibly have been too small to detect significant differences, secondly this study was done on monkey whereas Brannshöm *et al* 1980 used human teeth, thirdly because of climatic effects on the storage of the new Tubulicid [R], and finally we looked at the wall of our cavities and not at the floor. The reason we scanned the wall of the cavities is because adhesion is more important along this surface for limiting marginal leakage, and in clinical practice flat ground surfaces are not used as often as cavities.

Although most of the results were not significantly different, they suggest that on flat surfaces, five of the six treatment comparisons were different. However, these two variables could have a synergistic effect as indicated in the comparison between the cavity treated chemically and flat surfaces treated with new Tubulicid [R] and mechanical agitation. This may account for the different results obtained by Brannström *et al* 1980 and Jodaikin and Austin (1981) and Jodaikin *et al* (1981). It would therefore seem to be more appropriate to use cavities in order to investigate smear layer removal properties of cleansing agents as these more closely relate to their application in a clinical situation. Agents which do not require mechanical agitation to effect smear layer removal may have practical advantages over agents which require agitation, as it is sometimes difficult for a clinician to reach every surface in a prepared cavity.

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